Direct Cholangioscopy with Standard Ultraslim Endoscopes for Electrohydraulic Lithotripsy of an Incarcerated Large Bile Duct Stone

J Pohl, Dr.-Horst-Schmidt-Klinik, Wiesbaden, Germany

Received 5 February 2012; Revision submitted 5 February 2012; Accepted 1 April 2012

Abstract

Ninety percent of patients with intraductal biliary stones are successfully treated with sphincterotomy and subsequent stone extraction. However, technical difficulty increases with stone size and giant stones require fragmentation to facilitate endoscopic removal. For stones too large to be engaged in a basket for mechanical lithotripsy, laser and electrohydraulic lithotripsy have been proposed for stone fragmentation. Application of electrohydraulic lithotripsy (EHL) is best achieved under direct visualization during cholangioscopy, because shock waves can also injure normal tissue. We present the case of a patient who underwent direct cholangioscopy for EHL of a giant stone that could not be retrieved by endoscopic retrograde cholangiopancreatography (ERCP). This article is part of an expert video encyclopedia.

Keywords

Cholangiography; Endoscopic retrograde cholangiopancreatography; Giant stones; Lithotripsy; Video.

Video Related to this Article

Video available to view or download at doi:10.1016/S2212-0971(13)70200-0

Technique

Endoscopic retrograde cholangiopancreatography (ERCP), Direct cholangioscopy, Electrohydraulic lithotripsy (EHL).

Materials

1. Endoscope
   - EG 530 NP; Fujinon Inc., Saitama, Japan.
2. Accessories
   - Balloon catheter 5F; maximum diameter 15 mm Medizin Technik Wesel, Wesel, Germany.
   - Electrohydraulic lithotryptor: Lithotron EL-23; Walz Electronic, Germany.
   - Lithotryptor probe: 4F probe, Walz Electronic, Germany.
   - Stone basket: Memory Baskets 7FR Soft Wire, 15 mm diameter, Cook Medical, Winston-Salem, NC.

Background and Endoscopic Procedure

Ninety percent of patients with intraductal biliary stones are successfully treated with sphincterotomy and subsequent stone extraction. However, technical difficulty increases with stone size and giant stones require fragmenation to facilitate endoscopic removal. For stones too large to be engaged in a basket for mechanical lithotripsy, laser and electrohydraulic lithotripsy[1] have been proposed for stone fragmentation. EHL utilizes high-pressure shock waves that are generated by an electric high-voltage spark between two isolated electrodes located at the tip of a fiber. The electric sparks are delivered in short pulses that induce a spherical shock wave within the surrounding liquid that fragments the stone. Application of EHL is best achieved under direct visualization during cholangioscopy, as shock waves can also injure normal tissue.[1]

We present the case of a patient who underwent direct cholangioscopy for EHL of a giant stone that could not be retrieved by ERCP. Direct cholangioscopy using an ultraslim endoscope is an attractive alternative to the conventional mother–baby endoscope system, as it provides a single-operator platform and high-resolution image quality and allows advanced therapeutic interventions. The endoscope is advanced into the duodenum via the transnasal route. To prevent looping in the stomach, it is important to minimize gas insufflation. A J-turn is made in the second portion of the duodenum, and the tip of the endoscope is positioned *en face* with the papilla. Under direct visual and fluoroscopic control, a balloon catheter is advanced free hand into a branch of the intrahepatic bile duct and the balloon is inflated to anchor it inside the duct. The endoscope is then advanced over the balloon catheter into the common bile duct using a ropeway method. Some carbon dioxide is insufflated to optimize visualization in the bile duct, and intraluminal bile is suctioned after removal of the balloon catheter. When the stone is within the focus of the endoscope, the biliary system is filled with physiological saline infused through the working channel of the endoscope. A 4 French electrohydraulic lithotripsy probe is inserted through the channel and lithotripsy is carried out under direct vision with the tip of the probe touching the stone. Sparks are generated when the foot pedal is depressed. Care is taken not to activate the probe when the tip is in contact with the bile duct wall. The probe is activated only when it is properly immersed in saline and touching the stone.[1]

This article is part of an expert video encyclopedia. Click here for the full Table of Contents.

Because stone fragments and sludge generated during lithotripsy may obscure the endoscopic view of the baby endoscope, irrigation through the channel of the endoscope helps to maintain a clear view of the stones. Stone fragmentation is monitored endoscopically and is also confirmed by fluoroscopy with contrast introduced through the working channel. Once the large stone is fragmented, the ultraslim endoscope is removed. The stone fragments within the duct are then extracted with a Dormia basket and balloon catheters are passed through. Air refluxed into the bile duct after a sphincterotomy may mimic stones in the cholangiogram. In addition, contrast injected through the catheter may spill from the sphincterotomy. Using occlusion cholangiography with contrast injected under pressure through an occlusion balloon catheter ensures adequate filling of the ducts. The balloon catheter is also useful for differentiating air bubbles.

Key Learning Points/Tips and Tricks

- The novel direct cholangioscopy technique simplifies cholangioscopy.
- EHL is an effective technique for fragmentaton of complicated stones under direct visualization.
- EHL produces high-pressure shock waves in a fluid medium. The shock is delivered to the stone through the surrounding liquids. Therefore, stone fragmentation is dependent on liquid surrounding the stone, preferably physiological saline solution. To this end, we apply a simple trick: We use physiologcal saline as lens cleansing solution and deliver it constantly during the EHL procedure.

Complications/Risk Factors

- Shock waves can injure normal tissue and cause bleeding and even perforation. Therefore, EHL is best achieved under direct visualization during cholangioscopy.
- Several fatal cases were reported that might be due to air embolism following rupture of the bile duct during direct cholangioscopy with ultraslim endoscopes. Therefore, we strongly advocate the use of carbon dioxide instead of air for insufflation, and even more important: Avoid excess insufflation of any gas within the bile duct.

Alternatives

Laser lithotripsy; however, it might not be as effective as EHL.

Scripted Voiceover

A 56-year-old woman was admitted for electrohydraulic lithotripsy of an impacted biliary stone that could not be retrieved by ERCP. An occlusion cholangiogram shows the stone in the middle portion of the common bile duct. Fragmentation of the stone with electrohydraulic lithotripsy requires direct visualization to avoid collateral damage. Therefore, direct cholangioscopy with an ultraslim endoscope is employed. The endoscope is advanced via the transnasal route and a J-turn is performed in the duodenum so that the tip of the endoscope is positioned *en face* with the papilla that is wide open after previous sphincterotomy. Under direct visual and fluoroscopic control, a balloon catheter is advanced free hand into the common bile duct. The balloon is inflated to anchor the catheter inside the duct and now we advance the endoscope over the catheter into the common bile duct using a ropeway method. Some carbon dioxide is insufflated to optimize visualization in the bile duct. But pay attention: Always keep gas insufflation at an absolute minimum, because there have been some reports on putative gas embolizations. Now the stone is directly in front of endoscope and we remove the balloon catheter and fill the common bile duct with physiological saline that is infused through the working channel. A 4 French electrohydraulic lithotripsy probe is inserted and lithotripsy is carried out under direct vision with the tip of the probe touching the stone. Sparks are generated when the foot pedal is pressed. Special care is taken not to activate the probe when the tip is in contact with the bile duct wall. The probe is activated only when it is properly immersed in saline and touching the stone. Here we already notice a big crack within the stone and we do get a fascinating insight into the composition of the stone. For repeated shock wave delivery, the core of the stone is targeted. Because stone fragments and sludge generated during lithotripsy may obscure the endoscopic view, irrigation through the channel of the endoscope helps to maintain a clear view of the stone. At this stage, the large stone is already crushed into dozens of pieces. Stone fragmentation is monitored endoscopically and is also confirmed by fluoroscopy with contrast introduced through the working channel. Once the large stone is fragmented, the ultraslim endoscope is removed and ERCP is conducted. The stone fragments within the duct are then extracted with a Dormia basket and balloon catheters are passed through. At the end of the procedure, another occlusion cholangiography is performed. There are no remnant intraductal stones. Some air refluxed into the bile duct after a sphincterotomy may mimic stones in the cholangiogram. However, in this case, the dynamics of the air bubbles easily allow us to differentiate them from stones.

No competing financial interests exist.

Reference

1. Leung, J. W.; Chung, S. S. Electrohydraulic lithotripsy with peroral choledochoscopy. *BMJ* **1989**, *299*, 595–598.

Further Reading

Albert, J. G.; Friedrich-Rust, M.; Elhendawy, M.; *et al.* Peroral Cholangioscopy for Diagnosis and Therapy of Biliary Tract Disease using an Ultra-Slim Gastroscope. *Endosc.* **2011**, *43*, 1004–1009.

Pohl, J.; Ell, C. Direct Transnasal Cholangioscopy with Ultra-Slim Endoscopes: A One-Step Intraductal Balloon-Guided Approach. *Gastrointest. Endosc.* **2011**, *74*, 309–316.